

# Compact, Low Cost APD Arrays with Built-in Optical Amplification, Phase I

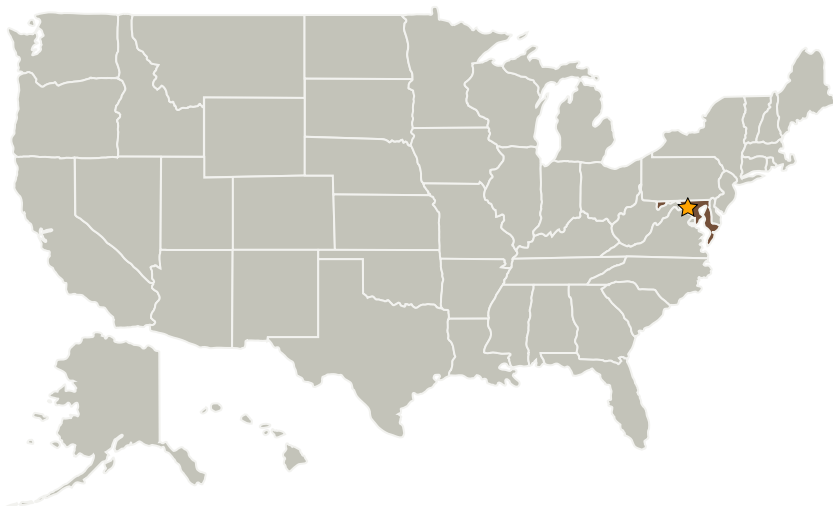
Completed Technology Project (2004 - 2004)



## Project Introduction

The overall goal of the proposed program by Epitaxial Technologies is to develop a compact, low-cost, low power, low noise and ultra-sensitive Avalanche Photo Diode (APD) arrays with built-in optical pre-amplification (in addition to internal electrical gain) and having a fill factor and bandwidth of 90% and 5.0 GHz respectively. We will accomplish this by developing novel APD structures and integrating the APDs with vertical cavity semiconductor optical amplifiers (VCSOAs). In Phase I of this project, we will design, model and simulate the performance of the APD arrays with built-in optical pre-amplification having -47 dBm sensitivity and lower noise than existing APD operating at 1550 nm. We will design and fabricate the 4 x 4 photodetector array with internal optical gain of 20 dB and assess its performance. In Phase II, we will design, fabricate and test the 256 x 256 arrays along with monolithic photoreceivers using detectors having built-in optical preamplifier and internal gain. In particular, we will combine photodetector arrays having built-in optical preamplifier with the Readout Integrated Circuits (ROIC) using an innovative bonding technique at the wafer level, in order to demonstrate single photon counting by operating in the Geiger-mode for solid state imaging LADAR receivers.

## Primary U.S. Work Locations and Key Partners



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## Organizational Responsibility

### Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

### Lead Center / Facility:

Goddard Space Flight Center (GSFC)

### Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

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Organizations Performing Work	Role	Type	Location
★Goddard Space Flight Center(GSFC)	Lead Organization	NASA Center	Greenbelt, Maryland
Epitaxial Technologies, LLC	Supporting Organization	Industry	Baltimore, Maryland

## Primary U.S. Work Locations

Maryland

## Project Management

**Program Director:**

Jason L Kessler

**Program Manager:**

Carlos Torrez

**Principal Investigator:**

Ayub Fathimulla

## Technology Areas

**Primary:**

- TX08 Sensors and Instruments
  - └ TX08.1 Remote Sensing Instruments/Sensors
    - └ TX08.1.1 Detectors and Focal Planes